

Empowering Coastal Communities through a Feasibility Study of Lobster Cultivation in Central Buton Regency

Ismi Rizqa Lina*

Universitas Insan Cita Indonesia,
INDONESIA

Nida Nurlivi Fauziyah

Universitas Insan Cita Indonesia,
INDONESIA

Dessy Damayanthi

Universitas Insan Cita Indonesia,
INDONESIA

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Abstract

Background: Central Buton Regency has significant coastal and marine potential to support the development of lobster aquaculture using floating net cages (KJA). Favorable oceanographic conditions and available coastal space provides strong opportunities for expanding this high-value fisheries sector. However, large-scale development faces sustainability challenges, particularly related to feed supply and ecosystem management.

Aims: This paper aims to assess the feasibility and development direction of lobster aquaculture in Central Buton Regency. The scope covers environmental suitability, initial production conditions, planned expansion to 500 floating net cages, and sustainable feed management strategies based on local resources.

Methods: Field surveys were conducted on 12–14 December 2025 to observe farming locations and engage with lobster farmers. This was followed by a Focus Group Discussion (FGD) on 15 December 2025 involving village leaders, farmers, relevant stakeholders, and three invited experts to discuss the industry ecosystems, local farming techniques, and integrated feed management.

Results: The results indicate that current feed demand can still be met using natural feed sources such as trash fish and shellfish. However, under the projected expansion to 500 floating net cages, daily feed requirements are estimated at approximately 5.5 tons for wet feed or 1.5 tons for pellet feed.

Conclusion: Lobster aquaculture development in Central Buton Regency is technically feasible but requires integrated feed management planning. The development of shellfish farming and locally produced pellet feed is essential to ensure sustainability, reduce dependence on wild resources, and enhance long-term competitiveness. As a follow-up, this program encourages the establishment of a sustainable mentoring model for farmers in feed management and strengthening their data-based production capacity.

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INTRODUCTION

The fisheries and marine sector plays a strategic role in supporting coastal livelihoods and local economic development in Indonesia (Stacey et al., 2019). Among marine commodities, spiny lobster (*Panulirus* spp.) has a high economic value and strong market demand, particularly in Asian export markets. This condition creates significant income opportunities for coastal communities but simultaneously intensifies exploitation pressure on wild lobster stocks (Lastria et al., 2023). Consequently, the development of lobster aquaculture is increasingly viewed as a sustainable alternative to balance economic utilization and resource conservation (Nursan et al., 2021).

Despite its economic potential, lobster aquaculture development in Indonesia remains constrained by technical and managerial limitations, including dependence on wild seed, limited technology adoption, and inadequate farm management (Solissa et al., 2022). Previous studies indicate that inappropriate site selection and poor water quality management contribute to low productivity and high mortality rates in lobster farming systems (Junaidi et al., 2022). Without a comprehensive

* Corresponding author:

Ismi Rizqa Lina, Universitas Insan Cita Indonesia, Indonesia. ✉irizqalina@gmail.com

feasibility assessment, aquaculture initiatives often face operational and financial risks that hinder long-term sustainability (Sarifudin et al., 2023).

Several feasibility studies on lobster aquaculture in Indonesia have focused on environmental suitability and business profitability. Research in Pulisan Village demonstrated that biophysical parameters such as water quality and oceanographic conditions strongly determine site feasibility (Sarifudin et al., 2023). Similarly, studies in East Lombok confirmed that lobster farming can be economically feasible under suitable conditions, although production risks remain significant (Aneswari et al., 2022). However, most of these studies were conducted as academic research and were not explicitly designed as community service-based interventions.

The application of Geographic Information Systems (GIS) has strengthened site suitability analysis by integrating multiple environmental and socio-economic criteria into spatial decision-making processes (Raihan, 2024; Ray, 2025; Syahrir et al., 2024). In parallel, financial feasibility studies incorporating risk analysis demonstrate that lobster aquaculture can generate positive economic returns when uncertainties related to survival rates and market dynamics are properly managed (Divu et al., 2024; Ronyastra, 2025). Nevertheless, the application of these analytical tools at the community level remains limited, particularly in less-developed coastal regions.

A clear service gap exists between the availability of scientific feasibility methodologies and the capacity of coastal communities to apply them in planning lobster aquaculture development. Many community-based initiatives are established without integrated assessments that combine environmental suitability, economic feasibility, and local readiness (Sahrul et al., 2023). This community service activity offers a form of scientific novelty by repositioning feasibility studies as participatory empowerment tools that support informed decision-making, aligning with integrated perspectives on sustainable ocean food systems (Yigitcanlar et al., 2022).

Central Buton Regency was selected as the focus of this community service activity due to its significant dependence on small-scale fisheries and limited diversification of coastal livelihoods. Most coastal households rely on capture fisheries with fluctuating income and high vulnerability to seasonal changes. In addition, the absence of structured aquaculture planning and limited access to technical knowledge have constrained the development of high-value commodities such as lobster. Therefore, this location represents a strategic area for intervention through participatory feasibility-based empowerment to enhance economic resilience and sustainable livelihood opportunities. Limited access to location-specific feasibility information has constrained community confidence and stakeholder engagement in aquaculture development (Aneswari et al., 2022). Therefore, this community service activity, entitled “Empowering Coastal Communities through a Feasibility Study of Lobster Cultivation in Central Buton Regency,” aims to provide an integrated feasibility framework to support sustainable lobster aquaculture development and strengthen coastal community livelihoods.

METHOD

This community service activity applied a participatory feasibility study approach to support coastal communities in Central Buton Regency in planning sustainable lobster aquaculture development. The approach was designed not only to assess technical and economic feasibility, but also to strengthen community capacity, stakeholder coordination, and evidence-based decision-making, as recommended in sustainable fisheries and aquaculture management (FAO, 2020; Sahrul et al., 2023). This approach integrated field-based assessment, community consultation, and expert facilitation, following best practices in community-based aquaculture and sustainable ocean food systems (FAO, 2020; Pauly & Zeller, 2017; Yigitcanlar et al., 2022).

The FGD involved a total of 36 participants representing a diverse range of stakeholders. These included representatives from the regional planning agency (Bappeda), the environmental agency (Dinas Lingkungan Hidup), and the fisheries agency (Dinas Perikanan), as well as sub-district heads (Camat) from several areas. The participants also comprised village heads and aquaculture practitioners, village-level officials, and fisheries extension officers. In addition, academics from Universitas Insan Cita Indonesia were involved. This composition reflected a multi-stakeholder

engagement integrating policymakers, technical institutions, local government authorities, practitioners, and academic actors.

Community members were not only involved as respondents but also actively participated in data collection. Selected farmers were guided to conduct basic environmental measurements, such as salinity and temperature, using simple instruments. This participatory approach aimed to build local capacity for independent water quality monitoring and ensure sustainability beyond the program, while fostering co-learning through practical skill development and knowledge transfer.

A. Study Area and Implementation Time

The activity was conducted in the coastal areas of Central Buton Regency, covering Gu, Sangiawambulu, Central Mawasangka, East Mawasangka, and Mawasangka. These bay-based coastal zones were selected because their geomorphological and oceanographic conditions are suitable for floating net cage (KJA) lobster farming, as demonstrated in lobster cage culture systems in Vietnam and Indonesia (Jahangiri et al., 2022; Jones et al., 2019).

The implementation took place in December 2025, consisting of:

- a. Field surveys (12–14 December 2025) in eight coastal bays, and
- b. A Focus Group Discussion (FGD) on 15 December 2025 involving farmers, village leaders, local government, and invited experts.

B. Approach to Community Engagement and Data Collection

This activity used a participatory field approach, where community members were directly involved in the identification of problems, assessment of local conditions, and formulation of development strategies.

1. Field Survey

Field surveys were conducted together with local farmers and fisheries officers to observe:

- a. Existing lobster cages and farming practices
- b. Environmental conditions (temperature, salinity, water movement, and bay protection)
- c. Access to farming sites and supporting infrastructure

These observations aimed to build a shared understanding between the academic team and the community regarding the suitability of each location for lobster aquaculture, following site-selection principles commonly applied in lobster cage farming (Hermawan, 2025; Syahrir et al., 2024).

Field surveys were conducted together with local farmers and fisheries officers to observe environmental conditions, cage structures, and farming practices. Direct involvement of community members followed the **community-based aquaculture** approach, which has been shown to improve sustainability and adoption of aquaculture innovations (FAO, 2020; Yigitcanlar et al., 2022).

2. Interviews with Lobster Farmers and Field Mentoring

Structured interviews were conducted with lobster farmers to obtain practical and experience-based information related to their aquaculture activities. The interviews focused on several key aspects, including stocking practices, types of feed and feeding frequency, survival and growth performance based on farmers' observations, as well as the main constraints encountered in daily operations. Through this process, the service team was able to identify actual operational challenges and capacity gaps at the farmer level, which served as a crucial basis for designing appropriate intervention strategies and future development programs (Sahrul et al., 2023).

Based on the findings from the interviews, field assistance activities were subsequently implemented with an emphasis on the operation of automated closed-pond systems. This mentoring aimed to introduce real-time monitoring and water quality control mechanisms to farmers, thereby reducing seed mortality rates and optimizing feed utilization (Biazi & Marques, 2023; Chandran et al., 2025; Fasya et al., 2025). Furthermore, the integration of automated systems supported predictive analysis of lobster seed growth (Ahmed et al., 2024), aligning with the principles of precision aquaculture that

emphasized data-driven management, efficiency, and sustainability in aquaculture practices (Malandrakis, 2025; Teixeira et al., 2021).

3. Focus Group Discussion (FGD)

An FGD was conducted as the main participatory forum involving:

- a. Village governments
- b. Lobster farmers
- c. Fisheries officers
- d. Three invited experts

The FGD served to:

- a. Validate field survey findings
- b. Discuss the feasibility of expanding lobster farming to 500 cages
- c. Formulate sustainable feed and production strategies

The use of FGD is widely recognized as an effective tool in community-based aquaculture planning to align scientific analysis with local knowledge and stakeholder interests (Yigitcanlar et al., 2022). Structured interviews and Focus Group Discussions (FGD) were used to capture farmers' experiences, operational constraints, and development needs. This participatory method was consistent with lobster farming development programs supported by ACIAR in Vietnam and Indonesia, where stakeholder engagement is essential for successful aquaculture planning (Jones et al., 2019).

C. Feasibility Analysis Framework

The feasibility of lobster aquaculture development was evaluated using four complementary dimensions that were relevant for community-based development programs.

1. Environmental Suitability

Environmental conditions observed during the field survey were compared with lobster farming requirements, including temperature, salinity, current velocity, and bay protection, which were key factors determining lobster survival and growth (Junaidi et al., 2022; Sarifudin et al., 2023).

2. Production and Feed Requirement Analysis

Based on field data and FGD discussions, a development scenario of 500 floating net cages (KJA) was formulated. Feed requirements were estimated using:

- a. Stocking density per cage
- b. Average lobster body weight
- c. Feeding practices used by farmers

Two feeding systems were compared:

- a. Natural wet feed (trash fish and shellfish), and
- b. Formulated pellet feed, which was considered more efficient and environmentally friendly for large-scale farming.

3. Socio-Economic and Institutional Assessment

A descriptive analysis was conducted to assess:

- a. Community readiness
- b. Farmers' experience and acceptance of new practices
- c. Institutional support from village governments and fisheries authorities

This assessment aimed to ensure that lobster aquaculture expansion would not only be technically feasible but also socially acceptable and institutionally supported.

4. Integration and Development Planning

All results from the field survey, interviews, and FGD were synthesized into a phased development plan, starting from existing small-scale cages toward a 500-cage system. This plan emphasized:

- a. Environmental sustainability
- b. Feed security
- c. Community participation
- d. Institutional coordination

Through this integrated approach, the community service activity provided a practical and science-based foundation for sustainable lobster aquaculture development in Central Buton Regency, in line with the goals of the community service program to link academic knowledge with real community needs.

RESULTS AND DISCUSSION

Results

1. Coastal and Oceanographic Potential of Central Buton Regency

Central Buton Regency possesses significant coastal and marine resources that support the development of lobster aquaculture zones. The potential development area covers five sub-districts, namely Gu, Sangiawambulu, Mawasangka Tengah, Mawasangka Timur, and Mawasangka. These areas are characterized by semi-enclosed bays that provide natural protection from extreme waves, making them suitable for floating net cage (KJA) systems.



Figure 1. Water Salinity Measurement Process

Oceanographic observations indicate that the coastal waters exhibit sea surface temperatures ranging from 28–30°C, salinity levels between 30–35 ppt, and moderate current velocities. In addition, nutrient availability in the waters is considered sufficient to support lobster growth. These environmental characteristics are consistent with those found in successful lobster farming areas in Vietnam, suggesting that Central Buton Regency has favorable natural conditions for sustainable lobster aquaculture development.

2. Results of the Field Survey (12–14 December 2025)

Field surveys conducted from 12–14 December 2025 aimed to assess existing lobster farming practices, environmental conditions, and socio-economic aspects of local aquaculture communities. The results showed that lobster farming activities are still dominated by small-scale operations with a limited number of floating net cages distributed unevenly across potential locations.



Figure 2. Floating Net Cages for Lobsters

Observations and interviews revealed that most farmers rely on traditional farming methods with minimal technological support. Water quality management was conducted based on experience rather than systematic measurement, and feeding practices primarily depended on natural feed without standardized feeding ratios. Furthermore, production records, survival rates, and mortality data were generally not documented, limiting farmers' ability to evaluate productivity and manage risks.

The survey identified eight potential and existing bay locations for lobster aquaculture development, as presented in Table 1.

Table 1. Initial Profile of Lobster Aquaculture Development Areas

No	Bay	Village – Sub-district	Number of Cages
1	Tolandona	Baruta Lestari - Sangia Wambulu	2
2	Tolandona	Jalan poros Sangiawambulu - Sangia Wambulu	6
3	Kolawa	Wadiabero-Gu	2
4	Mawasangka	Wakambangura - Mawasangka	3
5	Lianabangga	Mawasangka Tengah	1
6	Mawasangka	Waturombe - Mawasangka Tengah	4
7	Mawasangka	Wantopi-Mawasangka Timur	Not yet developed
8	Mawasangka	Batubanawa - Mawasangka Timur	Not yet developed

The table illustrated that lobster farming activities are concentrated in a few locations, while other areas with similar environmental potential remain underutilized.

3. Focus Group Discussion (FGD) Results (15 December 2025)

The Focus Group Discussion (FGD) conducted on 15 December 2025 involved village heads, lobster farmers, relevant stakeholders, and three invited experts representing industrial, technical, and sustainability perspectives. The FGD served as a participatory forum to validate field survey findings and to formulate strategic directions for lobster aquaculture development in Central Buton Regency. The invited experts and their respective themes were as follows:

- a. Prof. Dr. Laode M. Kamaluddin, M.Sc., M.Eng. – *Lobster Industry Actors and the Supporting Ecosystem*
- b. Bayu Priambodo, Ph.D. – *Potential and Lobster Farming Techniques Based on Local Environmental Conditions*
- c. Ida Bagus Made Suastika Jaya, M.Si. – *Integrated Feed Management as the Foundation for Sustainable and Globally Competitive Lobster Aquaculture*

One of the key technical outcomes of the FGD concerned feed supply sustainability in relation to the planned expansion of lobster aquaculture to 500 floating net cages (KJA) by 2026. Participants agreed that, under current conditions where the number of farming units remains limited, the supply of natural feed such as trash fish and shellfish can still be fulfilled from local capture fisheries. However, this approach was considered feasible only in the short term.



Figure 3. Focus Group Discussions with Experts

For medium- to long-term sustainability, the FGD emphasized the need for parallel strategies, including the initiation of shellfish farming (e.g., mussels and clams) as a complementary activity and the development of formulated pellet feed using locally available raw materials. These strategies were viewed as essential to reduce dependency on wild-caught feed resources and to enhance the resilience of the lobster aquaculture system.

Quantitative estimations discussed during the FGD indicated that the peak daily feed demand for a full-scale operation of 500 cages, each stocked with approximately 100 pearl lobsters with an average body weight of 1 kg, would reach approximately 5.5 tons per day when using wet feed. In contrast, the equivalent feed requirement would be approximately 1.5 tons per day if formulated pellet feed were applied. This significant difference highlighted the potential efficiency gains and logistical advantages of transitioning toward pellet-based feeding systems.

Overall, the FGD concluded that integrated feed management represents a critical leverage point for achieving sustainable, scalable, and globally competitive lobster aquaculture in Central Buton Regency.

Discussion

This discussion section elaborates on the findings obtained from the Focus Group Discussion (FGD) by interpreting their significance in relation to sustainable lobster aquaculture development. The discussion emphasizes key aspects related to feed availability, management strategies, and their broader implications for environmental sustainability and community-based aquaculture scaling.

Implications

The results of the Focus Group Discussion (FGD) indicated that feed availability and feed management is a critical determinant in the success of large-scale lobster aquaculture development. Although natural feed sources may be adequate during the initial expansion phase, prolonged dependence on wild-caught feed poses a significant risk of increasing pressure on coastal ecosystems and associated fisheries resources. As production scales up, particularly toward the target of 500 cages, the projected feed demand highlights the urgent need for more sustainable and controlled feed supply systems. These findings imply that feed strategy should be treated as a core component of aquaculture planning rather than a supporting element, especially in community-based lobster farming initiatives.

Beyond technical feasibility, the transition toward pellet-based feed systems must also be evaluated in relation to the community's adaptive capacity. Most small-scale farmers currently rely on low-cost natural feed sourced from local fisheries, which requires minimal financial investment. The shift to pellet feed introduces new cost structures that may not be immediately affordable for all farmers,

particularly those with limited capital. This condition indicates that technological feasibility does not automatically translate into socio-economic feasibility at the community level. However, the participatory discussions revealed that farmers are generally open to adopting new practices, provided they are supported through gradual capacity-building processes, access to collective financing schemes, and training in locally based feed production. Strengthening adaptive capacity through continuous technical assistance, cooperative-based feed procurement, and pilot-scale feed production initiatives is therefore essential to ensure that technological transitions remain inclusive, context-appropriate, and economically feasible for local communities.

In addition to these technical and socio-economic considerations, the planned expansion also presents significant institutional challenges, particularly in ensuring fair access and participation among small-scale fishers. Without appropriate governance mechanisms, there is a risk that aquaculture development may become dominated by better-capitalized actors, potentially marginalizing traditional fishers and creating inequality within coastal communities. Therefore, strengthening the role of fish farmer groups (Pokdakan) becomes crucial in managing resource allocation, coordinating feed distribution, and facilitating inclusive decision-making processes. Institutional arrangements such as cooperative-based management, transparent allocation of cage ownership, and collective agreements on production practices are necessary to maintain equity, strengthen social cohesion, and ensure the long-term sustainability of lobster aquaculture development as it scales up.

Research Contribution

This study contributes to the existing body of knowledge by providing quantitative projections of lobster feed demand derived from participatory expert discussions conducted through FGD. Unlike studies that rely solely on experimental or secondary data, this research integrates experiential knowledge from fisheries authorities, experts, lobster entrepreneurs, and local stakeholders. By linking feed demand estimation with community-based aquaculture planning, the study offers a practical framework that complements baseline environmental and spatial assessments. This approach can support the design of technical assistance programs and inform local policy formulation related to sustainable lobster aquaculture development.



Figure 4. Focus Group Discussion with the Fisheries Service, Experts, Lobster Entrepreneurs, and Stakeholders

This study contributes by providing quantitative feed demand projections derived from participatory expert discussions, complementing baseline environmental and spatial data. The integration of feed management considerations into community-based aquaculture planning offers a practical framework that can inform both technical assistance programs and local policy development.

Feed demand estimates presented in this study are based on assumptions discussed during the FGD, including stocking density, average lobster weight, and feeding regimes. Actual feed requirements may vary depending on growth rates, survival rates, and feeding efficiency under real farming conditions.

Limitations

The feed demand estimates presented in this study are based on several assumptions discussed during the FGD, including stocking density, average lobster weight, and feeding regimes. These assumptions reflect current best practices and expert judgment but may not fully capture variability under real farming conditions. Factors such as differences in growth rates, survival rates, feed conversion efficiency, and environmental fluctuations could result in deviations from the projected feed requirements. Consequently, the findings should be interpreted as indicative estimates rather than fixed values.

Suggestions

Future community service and research activities should prioritize pilot-scale trials of alternative feed systems, such as shellfish co-culture and locally formulated pellet feeds, to assess their technical, economic, and environmental feasibility. In addition, continuous monitoring of feed conversion ratios, lobster growth performance, and environmental impacts is strongly recommended. Such monitoring will support adaptive management strategies and provide empirical evidence to refine feed demand projections as lobster aquaculture operations scale up.

CONCLUSION

This study concludes that the development of lobster aquaculture areas in Central Buton Regency is technically and environmentally feasible for floating net cage (KJA) systems, supported by suitable oceanographic conditions such as optimal temperature, salinity, currents, and protected bay characteristics. Field findings show that existing farming practices remain small-scale, unevenly distributed, and largely traditional, while several coastal areas with similar potential are still underutilized; however, strong community and stakeholder engagement indicates readiness for expansion when supported by systematic planning and institutional coordination. Feed management emerges as the key determinant of sustainability, as natural feed sources are insufficient to support the planned expansion to 500 cages, with estimated daily requirements reaching 5.5 tons of wet feed or 1.5 tons of pellet feed, thus necessitating integrated strategies such as shellfish co-culture and locally produced pellet feed to ensure ecological and economic sustainability. Based on these findings, this community service activity has generated concrete policy and practical recommendations as tangible outcomes. For local governments, it is recommended to develop a structured aquaculture development roadmap that includes spatial zoning, support for local feed production, capacity-building programs, and improved access to financing, alongside strengthening institutional support for fish farmer groups (Pokdakan) to ensure equitable participation and prevent resource concentration. For farmer groups, the implementation of collective management systems, gradual adoption of pellet-based feeding, and routine water quality monitoring are recommended as practical and actionable steps toward sustainable and scalable lobster aquaculture development. Overall, this initiative provides not only a feasibility-based assessment but also an actionable and participatory framework integrating technical, socio-economic, and institutional dimensions to support long-term development.

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AUTHOR CONTRIBUTION STATEMENT

IRL served as the principal investigator and lead author, responsible for study design, field survey coordination, data analysis, and manuscript preparation. NNF contributed to field data collection, stakeholder engagement, and technical discussions during the Focus Group Discussion (FGD). DD contributed to data interpretation, validation of findings, and critical revision of the manuscript. All authors reviewed and approved the final manuscript.

AI DISCLOSURE STATEMENT

The authors used OpenAI during the preparation of this manuscript for language refinement, paraphrasing, and structuring of academic text. All outputs generated by the tool were carefully reviewed, verified, and edited by the authors. The authors take full responsibility for the content, accuracy, and integrity of the publication.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest, whether financial, institutional, or personal, that could have influenced the conduct of this study, data analysis, manuscript preparation, or publication.

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